EKO-VIMAR ORLAŃSKI®

Installation, Operation And Maintenance Manual

Wood gasification boilers from 18-80 kW (85-275 kBtu)

Orlan®

ISO 9001

Often copied but never duplicated

UL/CSA approved by Omni-Test Laboratories, Inc.

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EKO Line Boiler

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- DANGER: RISK OF FIRE OR EXPLOSION -- DO NOT BURN GARBAGE, GASOLINE, NAPHTHA, ENGINE OIL, OR OTHER INAPPROPRIATE MATERIALS
- WARNING: RISK OF FIRE
  DO NOT OPERATE WITH FLUE DRAFT EXCEEDING 0.085 INCHES WATER COLUMN
  DO NOT OPERATE WITH FUEL LOADING OR ASH REMOVAL DOORS OPEN
  DO NOT STORE FUEL OR OTHER COMBUSTIBLE MATERIAL WITHIN MARKED INSTALLATION CLEARANCES
  INSPECT AND CLEAN FLUES AND CHIMNEY REGULARLY
- CAUTION: HOT SURFACES
  KEEP CHILDREN AWAY
  DO NOT TOUCH DURING OPERATION
  MAXIMUM DRAFT MARKED ON NAMEPLATE

SAVE THESE INSTRUCTIONS

Introduction
And Important Information

Thank you for purchasing an Orlan EKO Wood Gasification boiler.

This boiler is designed to operate in the 91% to 95% overall system efficiency range when properly installed and operated and burning sufficiently dry wood fuel.

The boiler has been independently tested and has been certified to conform to ISO 9001, TUV, CE. Testing and certification for (North American certifications) UL 391, ETL and CSA are in progress.

As the owner you should familiarize yourself with the installation, operating and maintenance information included in this manual. Be sure to save it for future reference especially since it contains your warranty information.

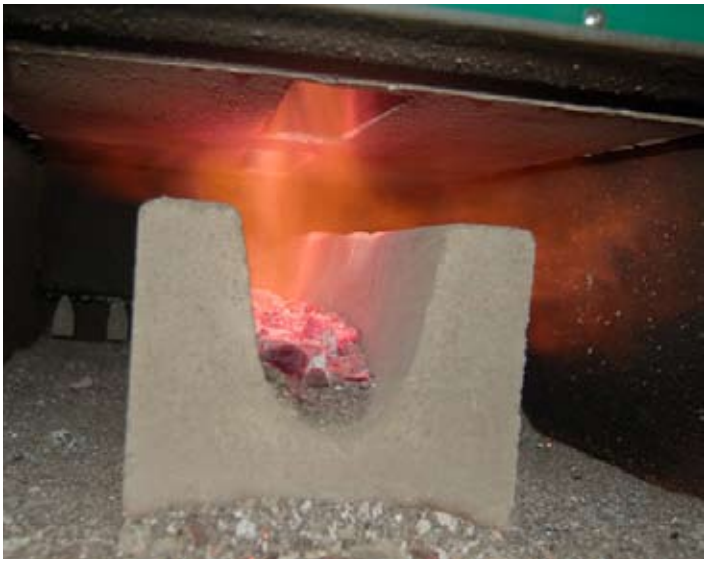
Warning !
There are a number of these Warning Alerts throughout this manual. Be sure that you read, understand and follow each of them.

Warning !
All systems should be designed and installed by a professional contractor and installer experienced and qualified in hydronic (hot water) heating systems. Local and national codes for solid fuel boilers must be followed.

EKO Line boilers are versatile, efficient and environmentally friendly:
- home heating and domestic water heating; can work together with other heating systems.
- high efficiency: less wood needed.
- clean burning: no visible smoke when fully operating; environmentally friendly.
- safer: clean burning results in little or no creosote buildup with minimal risk of a chimney fire.

Wood Gasification
Downdraft wood gasification boilers work by what is known as the “pyrolytic wood distillation” process. Dry wood is burned in the (top) primary combustion chamber, where heat from the flame breaks the wood structure down into charcoal and eventually, into combustible gas. This gas passes through the ceramic nozzle (or nozzles, depending on the model) at the bottom of the primary combustion chamber, where it is mixed with superheated air and burned cleanly at high temperatures (up to 2,000 degrees F) in the refractory-lined bottom chamber. This clean-burning flame produces little or no smoke. This hot gas then exits the boiler through the heat exchanger tubes and into the chimney. Gas which was 2,000 degrees in the secondary chamber is typically only 300 to 400 degrees when it reaches the chimney, meaning that 1,600 to 1,700 degrees is being transferred into the hot water jacket through the heat exchanger tubes.

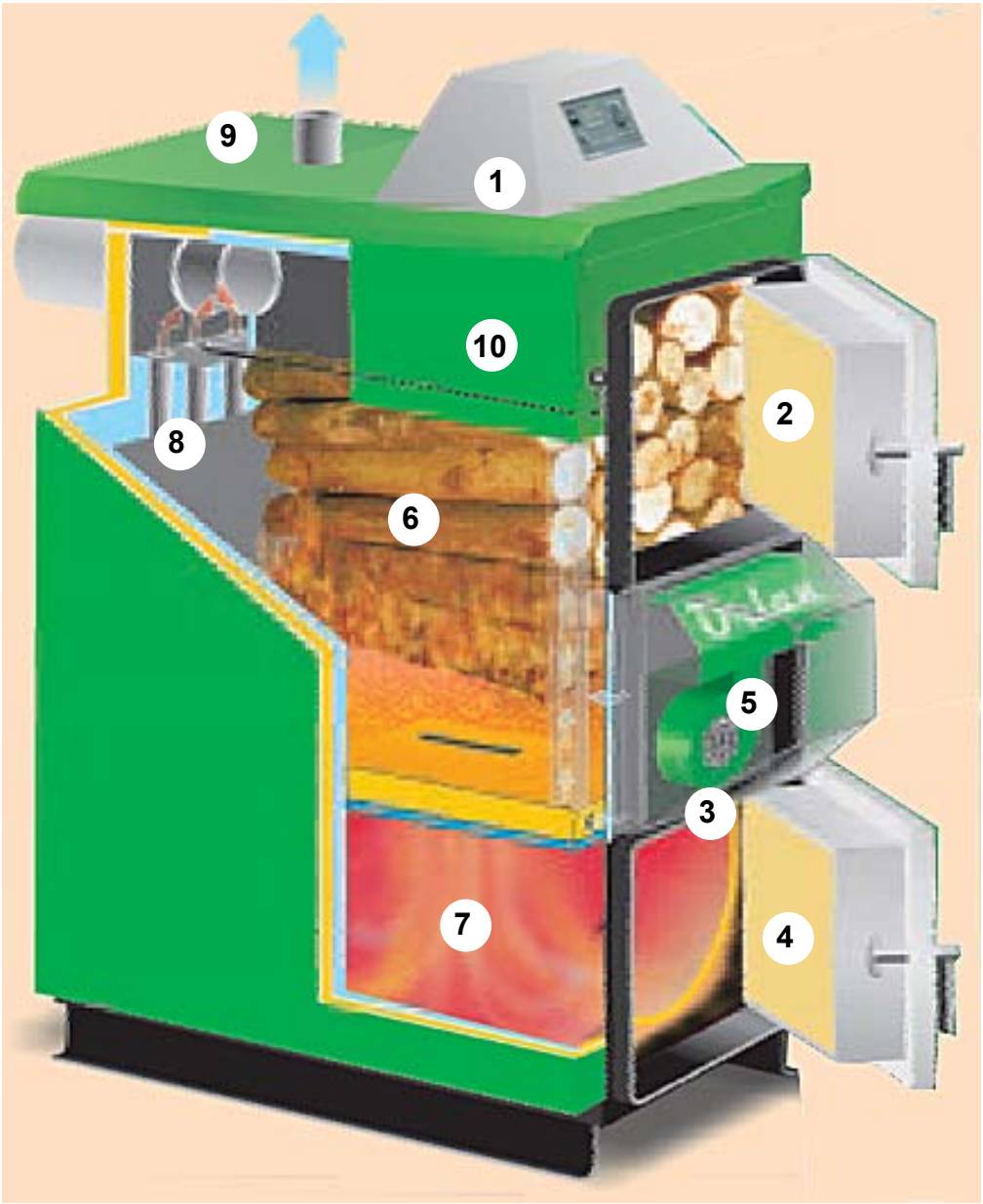
A clean-burning flame which sheds most of its heat on its way through the heat exchanger is the definition of a very efficient boiler.



Two views of the gasification chamber and nozzle burning at near 2,000 degrees, F.

Important Components

1.) Controller
2.) Loading Door
3.) Secondary Air Adjust
4.) Ash Door
5.) Forced Draft Fan
6.) Primary Burn Chamber
7.) Secondary Chamber
8.) Heat Exchanger Tubes
9.) Supply Water Outlet
10.) Bypass Damper Lever



Warning !
Attention to safety is critical in all phases of boiler system design, installation, operation and maintenance.

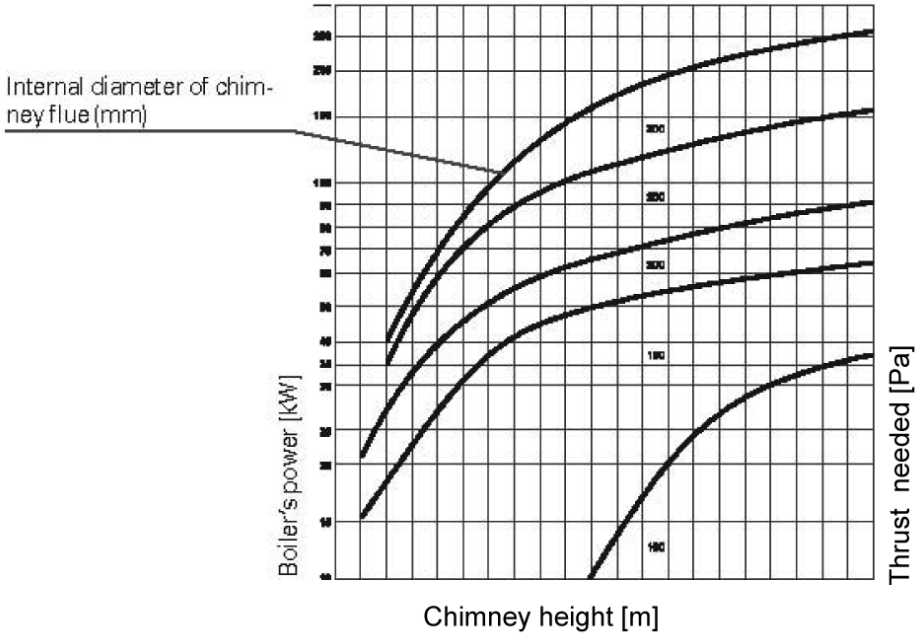
Safety
You must keep safety in mind during the installation, operation and maintenance of your boiler and heating system. During installation the boiler and some components may be heavy or sharp. During operation the boiler and associated plumbing can be very hot which can cause burns or fires. The proper methods need to be used while loading wood when the boiler is hot.

System Design
The plumbing diagrams in this manual are for basic information only and do not show all the valves, vents, fittings, etc. that are normally included in a finished boiler installation, nor do they cover all possible installation options.

It is the responsibility of the installing contractor to see that all controls are installed, configured and operating properly when the boiler installation is complete.

Chimney Specifications
The chimney or flue is one of the most critical factors in the successful operation of any solid fuel heater, including your EKO Line boiler. A good chimney will provide a continuous and dependable draft to pull the exhaust gases out of your boiler.The boiler must be connected to a tile-lined masonry flue or to a Type HT approved chimney. Minimum required flue size is 8x8” with square tile or 8” diameter round tile or stainless steel. No other appliance should be connected to this flue. The boiler should be connected to the flue with the shortest, most direct run of black stove pipe. Maintain a minimum of 18” between the flue pipe and combustible surfaces. Prior to operation, the installation should

The chimney flue connected to the EKO boiler should conform to the specifications specified below.



EKO 60 with 1,000 gallons of pressurized hot water storage and expansion tank.

be inspected and approved by qualified professionals (i.e., a chimney sweep, a licensed plumbing and heating contractor, electrician, etc.). Another important requirement is that the chimney and connecting pipe need to be insulated for safety and to prevent condensation and a reduction in the draft caused when the gas in the chimney cools too much. If there is still a problem with draft (too much or too little), draft inducing fans or draft regulators may need to be considered.
Unit is not to be connected to a chimney flue serving another appliance.

Hot Water Storage

For the best results, the use of a heat storage tank is recommended. A properly sized storage tank can cut wood consumption by as much as 40%. Hot water storage allows the boiler to run at optimum capacity regardless of the demand for heat from the building being heated. The stored heat can be recovered later, both stretching the time between boiler re-fuelings, and as an additional source of heat on very cold days. Generally, the bigger the storage tank the better, as the boiler is most efficient when running at full capacity. The rule of thumb on tank sizing is that 13 gallons of water can store about 1KW of boiler heat. Using the EKO 25 as an example: 13 gal/1KW x 31KW = 421 gallons, 421 gallons x 91% efficiency = 383 gallon minimum size water tank. A hot water storage tank connected to an EKO boiler can also be used to store hot water from a solar water heater.

Protecting the Boiler During a Pump or Power Failure

During the course of operating the boiler, there is always the possibility of a pump or power failure. It is recommended that you install an auxiliary power supply (i.e. UPS) to power the boiler fan, pumps and controller during a power failure. It is also a good idea to install a gravity feed storage tank above the boiler. Typically, this would be a water storage tank connected to a normally-closed zone valve (or at a minimum, a manual valve) that will allow hot water from the boiler to circulate into the tank in the event of a power outage.

Other Boiler Protection Considerations

- Do not use self-contained non-electric zone valves on the main heating zone as it is to be used as the overheat/dump zone. Such a valve would prevent the overheat control from cooling the boiler when necessary.
- Do not use any radiant floor heat tubing that does not have an oxygen barrier otherwise you must use a heat exchanger between the hard piping of the boiler and the radiant floor heat tubing.
- A backup power supply such as a UPS (battery-based Uninterruptible Power Supply) is required to operate the primary loop pump and dump zone valve if it is of the electrically operated variety. It

is preferable to have a non-electric dump zone valve.
- A primary loop pump must feed all zones.
- Each boiler should be connected to the heating capacity which equals that of the boiler output.
- To protect the boiler against low-temperature corrosion the end-user should assure return temperature does not reach lower than 120F. One way to do this is by installing a four-way mixing valve.

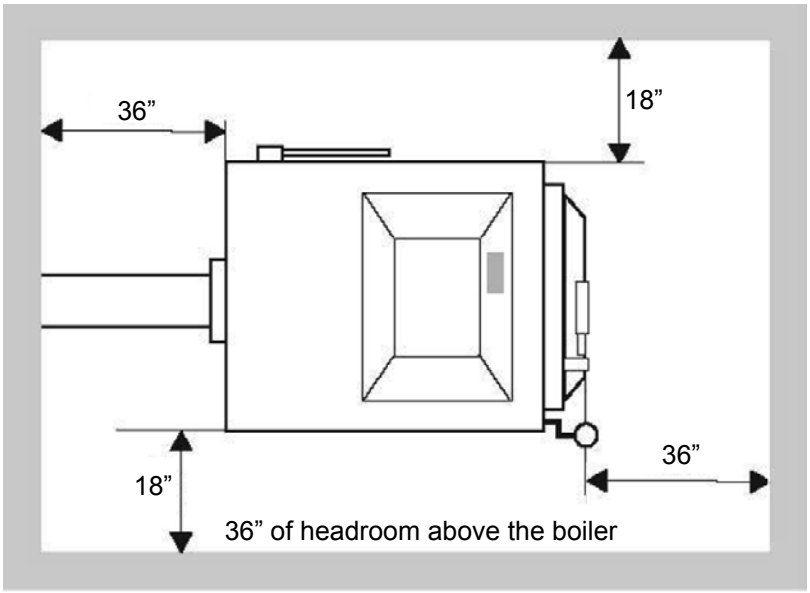
Installation
Orlan EKO boilers are designed to conform to and be installed in accordance with the stringent European regulations known as PN 87/B 02411 and PN 91/B-02413. When installed in the United States, all applicable local codes and regulations should be observed.

Location, Location, Location
You will need to have adequate room around the boiler for installation, operation, cleaning and maintenance. You will need plenty of room for loading the boiler and emptying the ash bin and room to use the cleaning tools provided. You also need adequate clearances from combustibles. The distance between the boiler and the surrounding walls should be sufficient to allow access to all of the boiler's parts, as specified in the clearance diagram below. The boiler must be positioned to provide minimal clearances from combustibles and surfaces: Left and right side = 18," top, rear and front = 36."

The boiler can be placed in a utility room, basement or outbuilding, along with wood storage. Putting the boiler in an outside location is recommended for easy access to wood storage, and to keep the mess and flame out of the house.

The boiler must be located on a level concrete floor or an other non-flammable surface. Wood gasification boilers are heavy; be sure to consider the weight when planning the installation.

CAUTION: Do not store fuel within the Boiler installation clearances or within the space required for fueling, ash removal, and other routine maintenance operations.



Recommended clearances.

Combustion Air
The boiler requires fresh air for combustion. It is critical not to starve the boiler of air, as the air supply affects the quality of the burn as well as the strength of the chimney draft. If any fans are used in the room where the boiler is located, they should be installed so as not to create negative pressure, i.e., they should not be pulling air from the room. Likewise, you do not want too much positive air pressure, as it can cause the boiler to burn out of control. You may need to pull outdoor combustion air into the room if there are backdrafts, insufficient draft or improper combustion, among other problems. You can easily check this by opening a window or door to see if the problem goes away.
Install in accordance with Appendix G of CAN/CSA-B365-M91.

Packing List
The complete EKO Orlan boiler is shipped from the warehouse in one crate.

Inside the crate you will find:
The boiler.
The cleaning tools (two or three, depending on the model).

Inside the boiler you will find:
This manual.
Pressure relief valve (30 psi).
Refractory gasification bricks (two or more pieces that form a tunnel under the nozzle or nozzles).

Boiler Set-Up
The boiler is shipped completely assembled and ready for installation and use. The boiler should be inspected inside and out for any defects or damage that may have occurred in shipping. After the boiler is placed in its permanent location and before the first firing, the refractory tunnel will need to be positioned directly under the nozzle or nozzles, so that the flame shoots directly down into the trough.

Piping
The direct connections to the boiler will be similar no matter which piping system you select (page 12). A detailed listing of pipe fittings, isolation valves, etc. is not part of this manual. If you have questions about designing your system, seek the advice of a hydronic heating professional.

However, some important piping considerations are included below:

A tee must be connected to the 2” NPT water inlet on the rear bottom of the boiler (return). In one port of the tee install a drain valve that is piped to a floor drain. In the other port of the tee install a line to the outlet of the circulating pump, upon which the inlet is connected to the outlet port of a 3- or 4-way mixing valve. One inlet of the mixing valve is fed from the heat zone piping return lines. The other inlet of the mixing valve is fed from a tee connected to the boiler outlet and the heat zone supply line. The purpose of this valve is to prevent cold water from entering the boiler, which can result in thermal shock causing mechanical warping and cracking, as well as creating condensation inside the firebox, which will result in corrosion inside the boiler.

Connect another tee to the 2” NPT water outlet on the top of the boiler (supply). In one port of the tee install the supplied pressure relief valve. Be sure to pipe the outlet of this valve with hard pipe (copper or black iron) to within 6 inches of the floor, and be sure there are no shut-off valves or other obstructions on the pipe. When this relief valve opens, it means that the boiler pressure has reached or exceeded 30 pounds per square inch. The steam and/or water released needs to flow freely and the pipe must be no more than 6 inches from the floor to prevent injury to anyone nearby. In the other port of the tee install a line to the tee connected to the boiler outlet and the heat zone supply line. Connect a line from the building water supply through a back flow preventer valve to the boiler INLET line. Water should only be introduced to the boiler when its temperature is below 160F.

There is a 3/4” NPT pipe sticking out each side of the boiler near the top. This is an emergency boiler cooling system not used in North American installations. The outlets can be covered with 3/4” NPT pipe caps with a 1/4” diameter hole drilled in each one. The caps cover the sharp threads and the holes keep pressure from building up in the pipe during boiler operation. This system is independent from the pressure vessel, so there is no boiler water involved.

Photograph showing one of the cooling pipe outlets and the pressure relief valve piped to within 6 inches of the floor with rigid copper pipe.

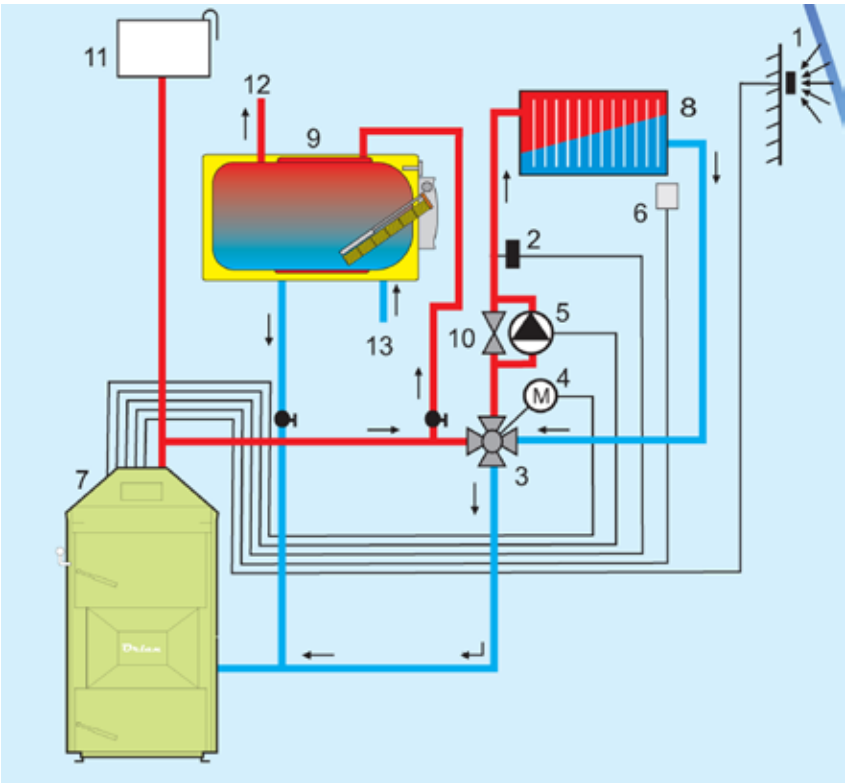
Four-Way Mixing Valve

A four-way mixing valve is an essential component of any EKO boiler installation. When properly installed, it allows hot supply water to be automatically mixed with cooler return water to avoid low return later corrosion at the boiler return water connection and maintain a relatively stable boiler water temperature. Four-way mixing valves also make it possible to maintain a steadier house temperature and can be used in either gravity or pumped hydronic systems.

Warning!
EKO wood gasification boilers should be installed in accordance with local codes. The boiler should be part of a closed, pressurized system with a pressure relief valve, expansion tank and if possible, a hot water storage tank.

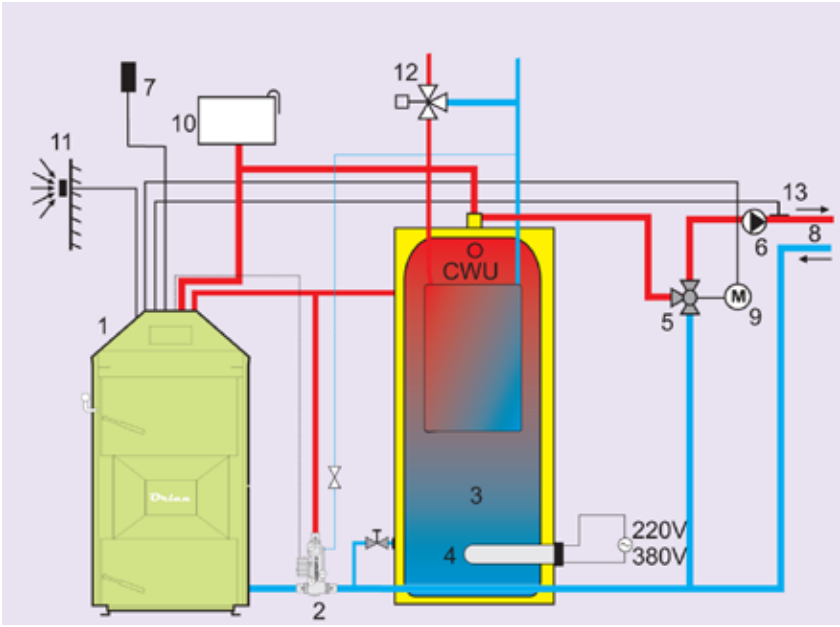
System with gravity-feed overheat protection.

1. Outdoor thermostat
2. Feed water temp. sensor
3. Four-way mixing valve
4. Mixing valve controller
5. Circulating pump
6. Room temp. sensor
7. Boiler
8. Radiator (in living space)
9. Water heater vessel
10. Differential valve
11. Pressure tank
12. Warm water exit
13. Cold water entry

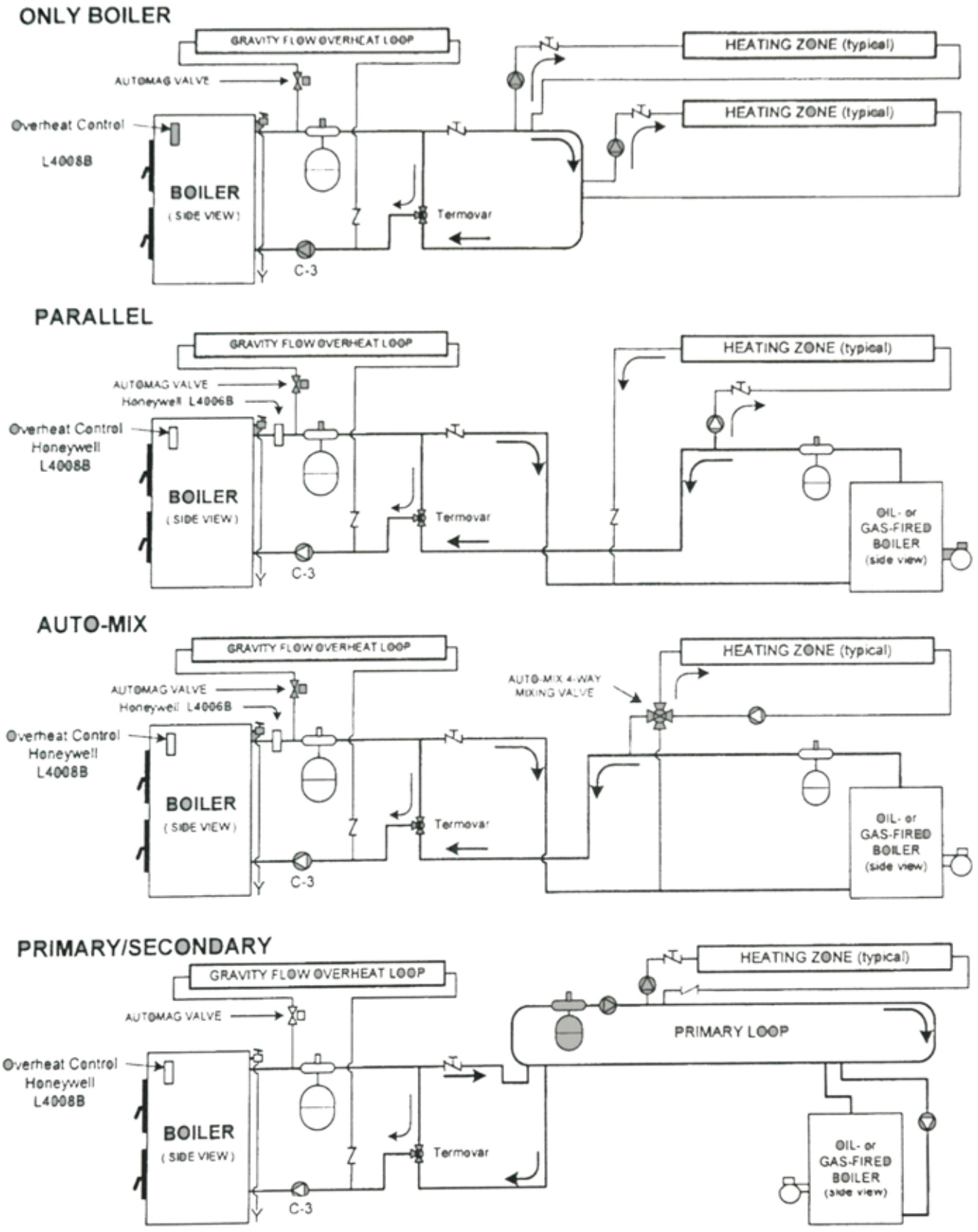


System with hot water storage tank.

1. Boiler
2. Mixing valve
3. How water storage tank
4. Electric heating element
5. Three-way mixing valve
6. Circulating pump
7. Room temp. sensor
8. Return water
9. Mixing valve controller
10. Pressure tank
11. Outdoor temp sensor
12. Mixing valve
13. Feed water temp sensor



Piping Design Possibilities

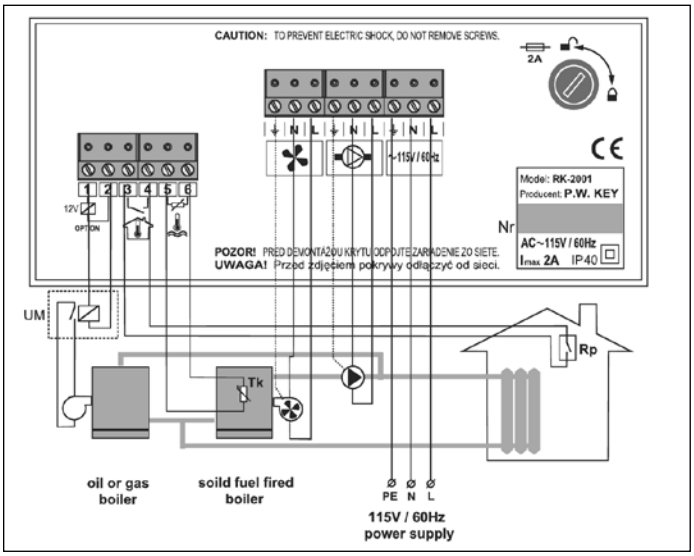


Filling the Boiler and Heating System.
Plain water is the recommended fluid for filling the EKO boiler and system it is connected to. The easiest way to fill the boiler and heating system is through a regulator connected to the home's domestic water supply. The regulator steps the pressure down to 12 psi, so that the boiler can be filled at the appropriate pressure. This connection to the home water supply can be left open or closed with a manual valve after the system is filled. The advantage to leaving it open is that any water lost is immediately made up and the system stays full of water at all times, including occasions when the pressure relief valve opens. The disadvantage to leaving the water connection open is that tap water contains oxygen, which will corrode the boiler and other components over time if enough oxygen is routinely let in, say by a leak.

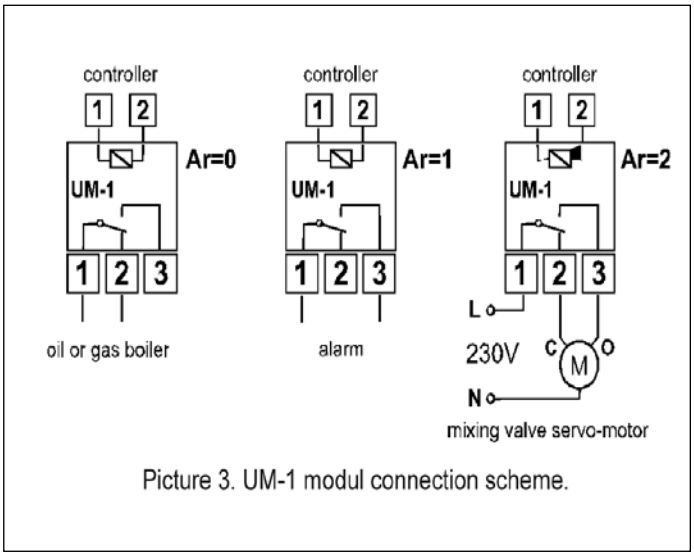
If the use of glycol is desired for freeze protection, be sure to use non-toxic hydronic heating system antifreeze, available from plumbing and heating supply outlets. Follow the directions carefully. The use of automotive glycol is not recommended, in part because it is toxic and can present a serious public health risk under some circumstances. For that reason, it is against code to use automotive glycol in hydronic heating systems connected to a public water supply.

Connecting a Pump and Room Thermostat to the Controller
There are several electrical terminals on the back side of the RK-2001UA controller where a pump and room thermostat can be connected. Access is through the bottom of the controller housing which is attached to the top front boiler panel with four screws. There are numbers and graphic symbols indicating the function of the various electrical connections, switches and dials on the bottom of the controller, as shown in the diagram below. It is always a good idea to check with your EKO dealer or distributor to determine the proper connections for your system.

RK-2001UA Connection Scheme



UM-1 Module Connection Scheme



Picture 3. UM-1 modul connection scheme.

Controller Features, Specifications and Operation

Front panel of the RK-2001UA controller.

Features

1. Master switch
2. Display, indicating boiler temperature and parameters (Fahrenheit)
3. Room thermostat indicator
4. Boiler thermostat knob
5. Circulating pump indicator
6. STOP/choose paraters/clear alarms button
7. START/choose parameters button
8. Start programming in service mode/confirm settings button

Controller Functions

Display	Parameter
П100	fan power or max fan power when Nr 1
Пr 1	automatic fan speed control
Пn 5	fan work time
Пu 6	fan pause time
P144	circulating pump launch temperature
Ph 4	circulating pump launch hysteresis
Pc 2	pause time between circ. pump 30 sec. work periods
L150	min boiler temperature
H195	max boiler temperature
h 10	boiler temperature hysteresis
A210	boiler overheating temperature
Fd60	no-fuel testing time during fuel firing start
Fb30	no-fuel testing time during work mode
Ar 0	additional output: 0-FUEL, 1-ALARM, 2-MIX

How the Controller Works

Boiler's temperature setting from 140 up to 176F	The desired boiler temperature is set with a knob (6). Current temperature is displayed on the screen (2).
Boiler overheat indicator	The LED (4) indicates when the boiler temperature exceeds 194F. This causes the fan to switch on.
Low fuel indicator	If the boiler temperature does not reach 140F after 30 minutes the indicator (8) and the fan will turn on.
Fuel shortage indicator	If the boiler does not reach 140F during burning (up to 2 hours) the indicator (8) will light up and the fan will turn off.
Fan status	A regulator modulates the fan speed slowing the fan as the boiler approaches the target temperature.
Pump status	If a pump is connected to the regulator the pump will remain off until the boiler temperature reaches 149F. It will then run until the temperature declines to 140F degrees.
Room temperature control	The controller can work together with a room thermostat so that the boiler maintains the temperature desired in the room. If there is a room sensor or thermostat connected to the controller, then the boiler will remain in surveillance stage (maintaining a boiler temperature between 140 and 149F).
“Flushing” during idle	The controller can be set to blow purge air into the upper burning chamber to get rid of accumulated wood gas when the boiler has reached its set temperature and is in idle mode. This keeps the fire from going out. The purging time is five seconds. The timing interval between “flushes” can be set between 1 and 9 minutes. *Note : Flushing settings should be made by a qualified technician.*

Warning!
The main circulating pump on the system should be connected directly to the RK-2001UA controller to assure proper operation and water circulation. This will help prevent overheating and result in the best performance.

Boiler Operation

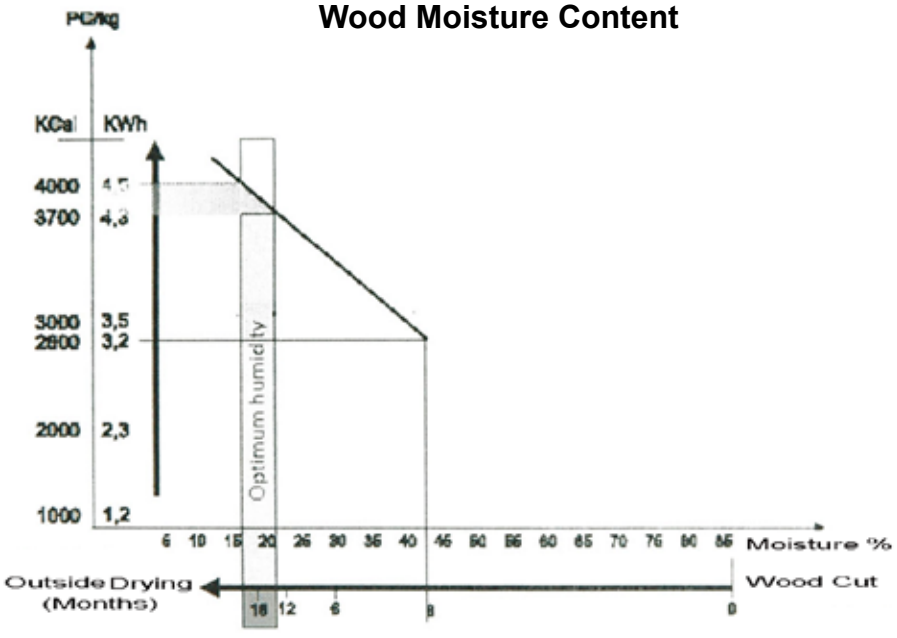
Warning !
Please read the following items.

- Please read the section about maintaining the boiler in the summer months carefully. Failure to protect your boiler from condensation during the warmer months can result in damage and voiding of your warranty. *(See page 22)*
- The section about operating the boiler in the event of a power failure is important for the safety of the boiler itself as well as ensuring that you have heat during a power failure. *(See page 13)*
- CAUTION: Do not use any flammable liquid (gasoline, lighter fluid, etc.) to help start or maintain a fire in your boiler as this can result in serious injury and property damage.
- CAUTION: Do not burn Garbage, Gasoline, Naphtha, Engine Oil, or other inappropriate materials.
- Be sure to keep all combustibles outside of the fire clearances as specified. *(See page 8)*
- Make sure that the nozzle does not become plugged with ash.
- See table of set up values for draft requirements during operation. *(See page 18)*

Wood Fuel Considerations

Dry firewood wood is the recommended fuel source for the EKO boiler. The optimum moisture content of the wood used to fuel the boiler should be between 15% and 20%. Hardwoods such as beech, oak, maple, hickory, etc. are best. While it is possible to burn dry softwood such as pine, spruce, fir, hemlock, etc., they will burn faster and require more frequent loading of the boiler than hardwood. The best way to determine wood moisture content is with a moisture meter. As a general rule, hardwood cut, split and stacked for one year under cover is usually ready for burning in an EKO boiler. Wood properly stored for two years is best. The manufacturer and distributor cannot be responsible for problems related to using wood that is not adequately dry or dense. The length of the wood pieces should be at least two inches shorter than the depth of the firebox.

Wood Moisture Content



Warning!
Using fuel types other than the dry wood specified in the Wood Moisture Content chart may result in unpredictable operation and poor efficiency. Neither the manufacturer nor Eco Heat Sales are responsible for problems resulting from unapproved fuels.

If burning pellets or other wood particles of the proper moisture content, be sure to place this material on top of larger pieces of wood to avoid clogging the ceramic nozzle.

Starting and Operating the Boiler for the First Time
Before firing up the boiler for the first time, the installation should be inspected and approved by a qualified individual (plumbing and heating contractor, electrician, etc.). The system should be full of water and vented and all other settings checked and tested, especially the pressure relief valve.

When starting the boiler from a cold start, the following steps should be followed in sequence:
1. Switch off the controller power.
2. Push the bypass damper lever forward to open the burning chamber bypass.
3. Put paper, very dry kindling and a few larger pieces of dry wood into the burning chamber.
4. Start the fire.
5. Open the bottom combustion chamber door to provide a natural draft.
6. Let the fire burn for 10-15 minutes (WARNING!! NEVER leave the boiler unattended in this state.
7. Add more wood.
8. Wait another 15 to 20 minutes for a charcoal layer to accumulate.
9. Close both upper and lower doors.
10. Pull the bypass damper closed (toward you) and switch on the controller power.
11. Ensure that gasification is occurring;*
12. Repeat steps 1 and 2.
13. Fill up the entire upper combustion chamber with wood.
14. Repeat steps 9 and 10

A properly sized and installed EKO gasification boiler should require loading every 8-12 hours, depending on the heat load and fuel being burned.

It is important to avoid obstructing the chimney bypass damper with wood in the combustion chamber when loading fuel. Ideally, reloading should occur when the fire has burned down to embers.

Warning!
Never turn on the controller power when the upper door is open.

Never force the fuel loading door closed. Doing so may damage the door or other parts of the boiler. Use only properly-sized firewood.

*Gasification should begin at this point, although it may take a few minutes of operation to become fully engaged. Gasification is occurring when 1.) you hear a soft rumble above the sound of the blower; 2.) little or no smoke is being produced from the chimney; and/or, 3.) flame (and no smoke) is visible coming from the nozzle when you open the gasification (bottom) chamber door.

Blue smoke coming from the chimney after gasification is initiated indicates wood that is either too wet or a nozzle that is not covered with coals. If you know the wood is dry and you're seeing blue smoke, turn off the fan, open the bypass damper, open the fuel loading door and move the wood around with the poker to better position the coals over the nozzle (or nozzles).

Warning!
The yellow “no fuel” light indicates when the boiler needs to be reloaded.

Boiler Shutdown
The boiler turns off in two ways: manually when the power switch on the controller is turned off, or automatically when the wood supply has burned out. NEVER turn the controller off for extended periods when the boiler contains burning fuel, as doing so could cause to it overheat. If you want to shut down the boiler, set the controller setpoint to minimum and let the fuel burn out.

Operating Temperature
Maintaining the proper temperature of the water in the boiler during operation is very important. For proper gasification to occur, the boiler water temperature should be 140F or greater.

At times, such as when there is a large call for heat, the return water temperature may become too low. This can result in poor gasification and decreased efficiency, as well as creosote buildup in the gasification chamber, heat exchanger tubes and chimney. Low temperature return water entering the boiler can also shorten the life of the boiler. The return water temperature should not be allowed to drop below 140F. This can be achieved with a properly installed 3- or 4-way mixing valve.

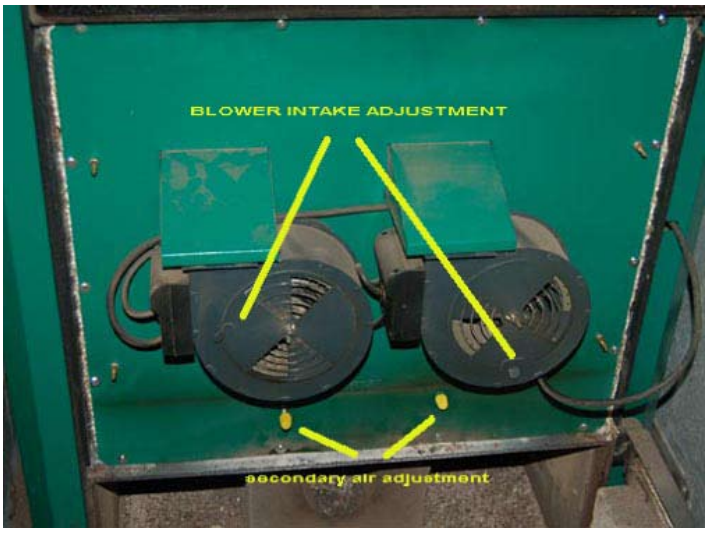
Primary, Secondary and Blower Air Inlet Settings
A critical phase of successfully setting up an EKO boiler for operation involves setting three air supply openings, as listed below and shown in the photographs on the facing page:
1. Primary Air Setting
2. Secondary Air Setting
3. Blower Air Inlet Setting

The following chart will help you determine how to set each one, depending on the model of boiler and the variables affecting its operation, specifically wood moisture content and chimney draft:

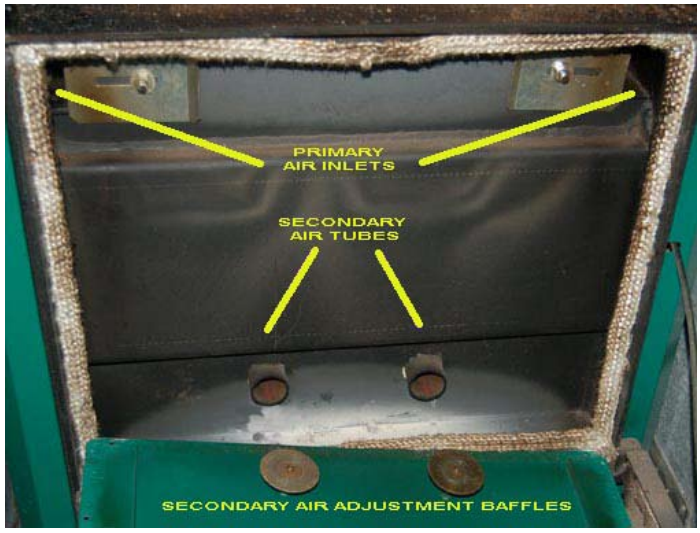
EKO Boiler Air Adjustment Guide
Table of set up values for EKO line boilers.

Model / BTU Output	Primary air opening (mm)										Number of turns for secondary air										% of air blower opening									
	Chimney draft 0.04 IWC					Chimney draft 0.08 IWC					Chimney draft 0.04 IWC					Chimney draft 0.08 IWC					Chimney draft 0.04 IWC					Chimney draft 0.08 IWC				
	Wood Moisture %					Wood Moisture %					Wood Moisture %					Wood Moisture %					Wood Moisture %					Wood Moisture %				
	15	20	25	30	35	15	20	25	30	35	15	20	25	30	35	15	20	25	30	35	15	20	25	30	35	15	20	25	30	35
E18 65k BTU	9	9	10	11	12	9	9	9	10	11	3	3	3	3.5	4	3	3	3	3	3.5	30	30	30	30	40	30	30	30	30	30
E25 85k BTU	9	9	10	11	12	9	9	9	10	11	3	3	3.5	3.5	4	3	3	3	3.5	4	50	50	50	60	70	50	50	50	50	60
E40 137k BTU	9	10	10	11	12	9	9	10	10	11	3	3	3.5	4	4	3	3	3.5	3.5	4	100	100	100	100	100	100	100	100	100	100
E60 205k BTU	9	9	10	11	12	9	9	9	10	11	3	3	3.5	4	4	3	3	3	3.5	4	50	50	60	70	80	50	50	50	60	70
E80 275k BTU	9	9	10	11	12	9	9	9	10	11	3	3	3.5	4	4	3	3	3.5	3.5	4	100	100	100	100	100	100	100	100	100	100

Example:
The EKO 25 is an 85K Btu boiler burning wood at 25% moisture content with 0.04iwc draft in the chimney. By this calculation, the secondary air setting should be 3.5 turns out.



Blower inlets (top) and secondary air adjustment on an EKO 60.



View behind the blower plate of the primary air inlets (top) and the secondary air tubes and valves.

What the Air Controls Do
The sliders on the blower (or blowers, depending on the model) determine how much air is available to both primary and secondary combustion chambers. These openings are the sole source of air for all combustion in the EKO boiler.

The primary air inlets determine how much air is available in the upper (primary) combustion chamber, where the fuel undergoes pyrolysis.

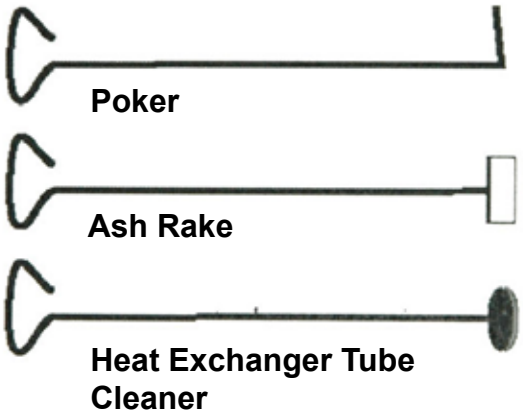
The secondary air inlets reulate how much air goes into the steel tubes (shown in the photograph), where it is superheated before being used by the nozzle (or nozzles) to achieve secondary combustion (gasification).

Proper adjustment is critical to optimum boiler peformance. Smoke coming out of the chimney (if dry wood is being burned and the fuel is properly positioned over the nozzle), usually indicates that not enough air is reaching the secondary air tubes.

Note:
The steel plate upon which the fan (or fans) is mounted can be removed with 12 sheet metal screws to gain access to the primary air inlet sliders (right photograph). When replacing the plate, be sure to apply even pressure to all the screws to insure that the gasket forms a consistent seal. Failure to do so will allow smoke to leak around the gasket and into the boiler room.

Maintenance
Proper maintenance of the boiler is essential for reliable, efficient and safe operation. This will also contribute to longer boiler service life. There are specific maintenance guidelines to follow during the heating season, and others to follow during the off-season.

Standard Cleaning Tools
These are the tools supplied with a boiler. Note that the EKO Super 1 model is not shipped with a heat exchanger tube cleaner.



Fan Maintenance
The blower fan (or fans) is an essential part of boiler operation, and should be kept clean. It is advisable to monitor the fan's condition and clean it from time to time with a soft bristle brush.

Warning!
Operating the boiler with the bottom door open can cause the blower fan to overheat.

Routine Cleaning During the Heating Season
Ashes produced in the firebox during boiler operation fall down through the nozzle into the lower gasification chamber. During fuel loading, any ash remaining in the upper combustion chamber can be pushed down through the nozzle with the tool provided, using care not to damage the nozzle. Accumulated ash should be cleaned out of the lower chamber as needed, typically every 3-5 days.
Disposal of Ashes - Ashes should be placed in a metal container with a tight-fitting led. The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. Other waste shall not be placed in this container. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled

EKO Super 1 Model Heat Exchanger Tubes
The EKO Super 1 model boilers are equipped with a lever-operated heat exchanger cleaning device consisting of spiral steel elements (turbulators) that clean the tubes as they are moved up and down. Vigorously moving the handle back and forth either before or after each fuel loading will help assure that the heat exchanger does not become clogged with creosote, soot or ash. The moving turbulators knock any residue that has accumulated in the tubes back down into the ash pit/secondary combustion chamber, where it can be cleaned out with the ashes. The lever should not be operated while the chimney bypass damper is open.

Cleaning the EKO Standard Model Heat Exchanger Tubes
On the EKO standard models, the heat exchanger tubes should be manually cleaned every two weeks using the following procedure. (Note: The bi-weekly cleaning routine described as follows is not necessary with the Super 1 models).

1. Remove the back panel and unscrew the heat exchanger cover plate with a metric wrench (from 13 to 17mm, depending on the model). IMPORTANT: Use care when screwing and unscrewing the retaining nuts. Lubricate the threads before removing the nuts, and avoid excessive force when tightening them back down.
2. Clean each heat exchanger tube for its entire length, using the tool provided. Be sure that soot and creosote do not accumulate at the bottom of the tubes. Clean any soot that has accumulated in the back of the boiler behind the tubes.
3. To facilitate cleaning, it is a good idea to burn dry potato skins (about 10 liters) in the boiler a day or two prior to cleaning. The starch in the potato skins acts as a catalyst, allowing the boiler to burn off accumulated soot and creosote more easily.

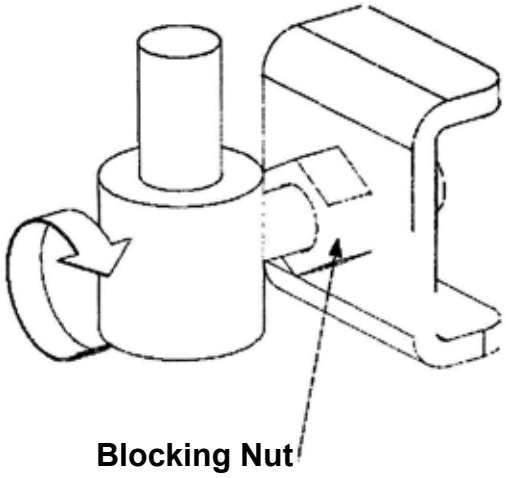
The heat exchanger tubes are susceptible to ash, soot and creosote buildup, which diminishes their ability to transfer heat, making the boiler less efficient. A good way to monitor their condition is with an instack probe thermometer. Dirty tubes will result in higher temperatures (above 350-400 degrees, F) at the chimney outlet.

Maintaining Tight Seals
It is very important to maintain tight seals on the doors, heat exchanger cover plate and the firebox bypass chimney damper. Poor seals can result in smoke and gases leaking out of the boiler and lead to uncontrolled burning which may cause the boiler to overheat. The fiberglass rope used to seal both doors and the heat exchanger cover should be inspected regularly and treated with graphite or some other lubricant (i.e. motor oil or WD-40) as needed, to keep them flexible.

Over time (typically one heating season) the rope seals on the doors can become flattened through normal use. When this occurs, the door hinges can be adjusted to compensate for the new shape of the sealing rope, as follows:

1. Remove the door.
2. Loosen the cap.
3. Turn the hinge 360 degrees.
4. Tighten the blocking nut to block the hinge retaining screw.

Warning!
The upper and lower hinges should be adjusted at the same time.



Warning!
Chimney inspection and maintenance is a critical part of any wood burning maintenance schedule. Inspect it at least once annually—preferably at the start of heating season. Clean as needed.

Creosote - Formation and Need for Removal
When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire. The chimney and chimney connector should be inspected at least twice monthly during the heating season to determine if a creosote buildup has occured. If creosote has accumulated it should be removed to reduce the risk of a chimney fire.

CSA Suggestions:
Establish a routine for the storage of fuel, care of the appliance, and firing techniques.
Check daily for creostoe buildup until experience shows how often cleaning is necessary
Be aware that the hotter the fire, the less creosote is deposited, and that weekly cleanings may be necessary in mild weather, even though monthly cleaning may be enough in the coldest months.
Have a clearly understood plan to handle a chimney fire.

Prolonged Power Failure

The boiler air intake flap is closed when fan is not in operation and therefore not designed to operate in event of power failure. A water circulation loop should be installed that would dissipate at least 10% of the estimated rated heat output of the boiler should be installed and only made inoperative by a deliberate manual action. The minimum pipe size should be 3/4” diameter with a room ambient temperature of 65F and a mean water temperature of 180F. The loop should be positioned above the boiler with feature that promote natural thermal circulation of the water. The recommended piping be such that excessive pressure will not be developed in any portion of the boiler. See page 12 for piping diagrams.

Off Season Preparation
Acids produced during the woodburning process can form when exposed to moisture inside the firebox, heat exchanger tubes and secondary combustion chamber. It is important that the boiler be properly prepared for the off season (summer) idle period. The upper and lower combustion chambers, heat exchanger tubes and chimney bypass damper should all be thoroughly cleaned of creosote, soot and ash. After the boiler is cleaned, both doors should be left open to avoid condensation.

Troubleshooting

Problem	*Cause*	*Remedy Suggested*
Boiler does not reach the temperature needed	Problems starting fire	Refer to page 17
	Wood too moist	Use properly seasoned wood
	Primary air conduit choked	Call service – not covered by warranty
	Secondary air conduit choked	Call service – not covered by warranty
	Smoke tube of heat exchanger choked	Clean with supplied cleaning shield or call service – not covered by warranty
	Wrong regulation of the air and wood gas	Call service – not covered by warranty
	Nozzle damaged	Replacement part – not covered by warranty
	Fan's gasket damaged	Replacement – not covered by warranty
	Fan damaged	Replacement – not covered by warranty
Smoke coming out of the cleaning cover	Leak on a seal rope	Repair/replace rope or call service – not covered by warranty
	Seal rope worn	Rope's replacement – not covered by warranty
	Cover warped – overheating	Replace cover or call service – not covered by warranty
Smoke coming out while loading (a little smoke is acceptable)	Strong winds blow the smoke back into the chimney	Consider installing a special chimney cap – not covered by warranty
	Inadequate chimney	Consult a chimney maintenance professional (chimney sweep)
Smoke coming out of the loading door when closed	Leak on a seal rope	Adjust door hinge per instructions
	Seal rope worn	Replace rope or call service – not covered by warranty
	Door damaged	Replace door – not covered by warranty

Problem	*Cause*	*Remedy Suggested*
Regulator does not work	No power	Check the wiring and circuit breakers
	Fuse damaged	Replace fuse – not covered by warranty
	Live wire conduit damaged	Inspect and repair wire
	Temperature sensor damaged	Call service
	Regulator damaged	Call service
Blower fan not working	Thermal protection engages	Investigate reasons for boiler overheating
	No power in regulator	Check fuse and wiring
	Fan damaged	Call service – fan replacement
	Regulator damaged	Call service
	Fan blocked	Inspect and clean the fan
Blower fan making noise	Bearings damaged	Call service – fan replacement
	Condenser damaged	Call service – fan replacement
	Fan clips loosened	Check, turn the clips tight
	Fan blades dirty	Clean and check
	Debris in fan cover	Clean and check
Blower fan working poorly	Dirty fan blades	Check and clean
	Creosote on the fan cover	Check and clean
Explosion or puffing in the firebox	Problems with startup	Refer to page 17
	Chimney draft too low (below 0.40”wc)	Rebuild chimney. Consider use of WKO exhaust fan
	Chimney draft too intensive (over .080”wc)	Use exhaust regulator
	Wood too small or too dry	Mix with larger humidity fuel as to increase humidity level (should be about 15-35%)
	Clogged heat exchanger tubes	Clean the exchanger or call service – not covered by warranty

RK-2001UA Controller Technical Data

Power	230V +/- 10%
Rate supply voltage (with no fan)	< 4VA
Temperature measurement range	32 - 210 +/-1 F
Temperature measurement sensors	KTY81 210
Temperature regulation range	140 – 176 F
Electrical protection (fuse)	1A / 220V

RK-2001UA Controller Service Parameters

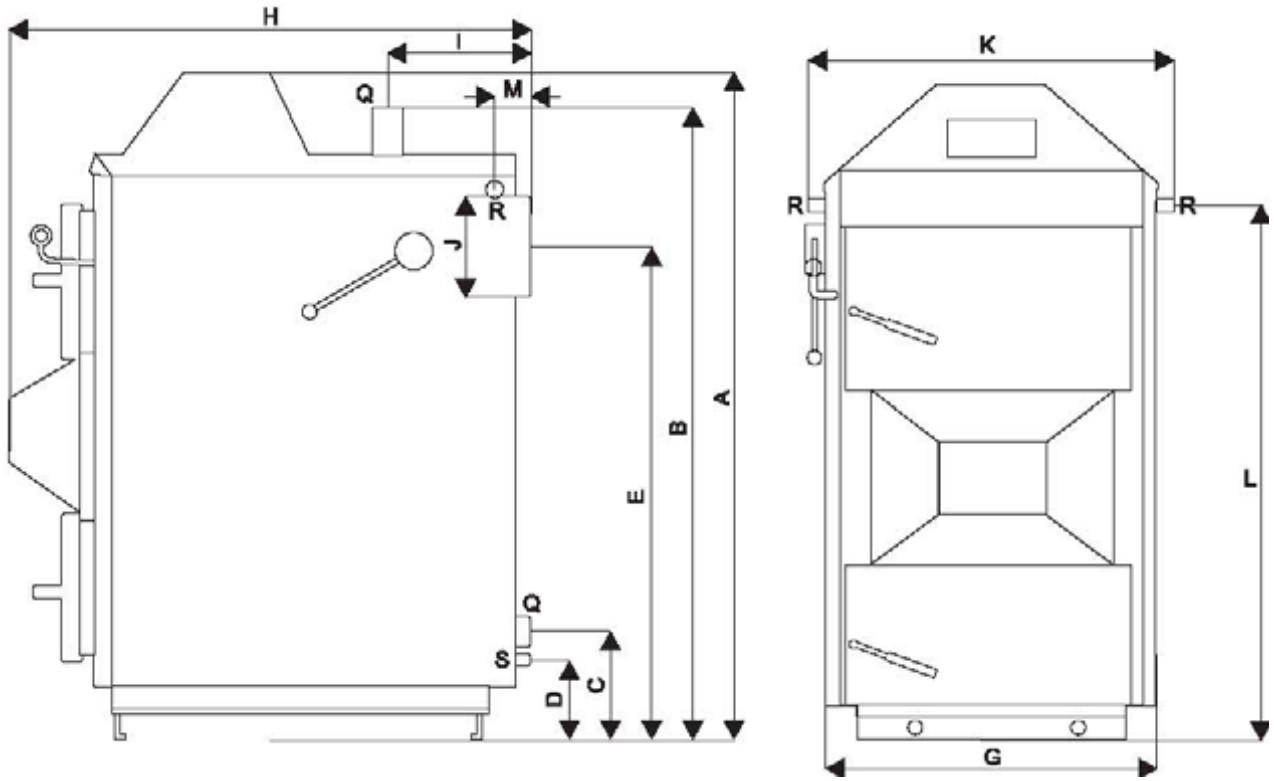
Display	Parameter	Min	Max	Step	Factory default
П100	fan power or max fan power when Nr 1	50	100	10%	100
Пr 1	automatic fan speed control	–,0	10	1	1
Пn 5	fan work time	–,5	60	1s	5
Пu 6	fan pause time	1	99	1min	6
P144	circulating pump launch temperature	85	160	1ºF	144
Ph 4	circulating pump launch hysteresis	2	20	1ºF	4
Pc 2	pause time between circ. pump 30 sec. work periods	–,1	99	1min	2
L150	min boiler temperature	85	150	5ºF	150
H195	max boiler temperature	175	195	5ºF	195
h 10	boiler temperature hysteresis	2	20	1ºF	10
A210	boiler overheating temperature	195	210	1ºF	210
Fd60	no-fuel testing time during fuel firing start	–,1	99-4h	1min	60
Fb30	no-fuel testing time during work mode	–,1	99-4h	1min	30
Ar 0	additional output: 0-FUEL, 1-ALARM, 2-MIX	0	2	1	0
Prod	return to factory settings after pressing OK				
outP	test of circ. pump output (press OK to launch the test)	outP	out1		
outП	test of fan output (press OK to launch the test)	outП	out2		
outr	test of additional output (press OK to launch the test)	outr	out3		
End	quit service mode after pressing OK				

Boiler Technical Data

Boiler Type		um	ORLAN 18	ORLAN 25	ORLAN 40	ORLAN 60	ORLAN 80
Power		kW	4+18	5+31	8+40	15+60	25+80
Efficiency		%	85	91	91	91	91
Weight – STANDARD *		lb	870	1124	1279	2006	2458
Weight – SUPER *		lb	937	1157	1312	2150	2568
Casing height – approx		A-inch	44	52.7	61.8	60.4	62
Heating water outlet height - approx		B-inch	47.6	51.4	61.4	62	64
Heating water inlet height - approx		C-inch	8.5	9.3	8.7	8.3	9.6
Waste outlet height - approx		D-inch	5.7	5.7	5.1	5.7	6.9
Chimney conduit height - approx		E-inch	34.3	37.8	48	46	47.6
Casing width - approx		G-inch	21.5	23.6	23.6	29.1	29.1
Depth - approx		H-inch	37.8	40.9	40.2	52.8	67
Heating water outlet - approx		I-inch	13.4	12.6	13	22.6	23.6
Chimney conduit diameter - approx		J-inch	7.1	7.9	7.9	8.3	8.3
Width with a coil - approx		K-inch	26	28.3	28.3	33.9	33.9
Height of coil connection - approx		L-inch	39	43.3	52.4	51.6	51.2
Coil outlet - approx		M-inch	10.2	5.9	10.2	14.4	12.4
Diameter of feeding and return ferrule		Q-inch	2	2	2	2-1/2	2-1/2
Diameter of the coil ferrule		R-inch	¾	¾	¾	¾	¾
Diameter of a drain valve		S-inch	½	½	½	½	1/2
Water capacity		gallons	14.5	19.75	24.5	47.5	54
Loading chamber capacity (gasification)		ft3		4.1	6.5	11	16.4
Power consumption		W	50	50	50	100	100
Wood length		inch	20	20	20	30	39
Wood humidity	recommended	%	15-25				
	admissible	%	15-25				
Voltage / frequency		V/Hz	230/50				

Boiler Type	um	ORLAN 18	ORLAN 25	ORLAN 40	ORLAN 60	ORLAN 80
Chimney flue needed	Pa	15-20				
Electric protection range		IP 40				
Max pressure	IWC	3.44				
Average fumes temperature	F	464	320			

Note: Approx — approximate dimensions are not for construction
Note: IWC or iwc = inches of water column



Warranty — USA and Canada

Eco Heat Sales warrants the residential steel boiler identified below and the hot water tank or coil, and the cast iron doors and grates against defects in material and workmanship under normal home use and service, TO THE ORIGINAL PURCHASER AT THE ORIGINAL INSTALLATION SITE in the United States and Canada, under the following terms:

BOILER BODY
LIMITED 20 YEAR WARRANTY

Subject to all the limitations stated below, Importer warrants the steel boiler body (but not including cast-iron doors, coil or other components) against defects in materials and workmanship resulting in breaks or leaks causing significant impairment of performance.

IMPORTER'S OBLIGATION: The Importer's sole obligation under this limited warranty is to provide payment of the below listed percentage of the cost of the repair of the warranted item. The importer may at their option decide to use this sum as a partial allowance to replace the warranted items. Importer will pay all required labor and the cost of all materials for the repair of the boiler defects arising during the first five (5) years of the warranty period. In years six (6) through twenty (20), Importer will pay for a percentage of labor and materials for the repair of the boiler body up to a maximum of the same percentage of the Importer's retail price for the BioMass NextGen model during the year in which the boiler was originally purchased. Shipping charges in connection with replacement or repair shall be paid by the owner.

Warranty Year	% of Coverage
1-5	100%
6	60%
7	50%
8	40%
9	30%
10-20	20%
21+	0%

Example #1: Repair costing $250 in year 7. Importer will pay $125.00 (50%) of this repair.

OTHER COMPONENTS - LIMITED THREE YEAR WARRANTY

- This limited warranty covers only repairs or replacements resulting from defects in materials and workmanship.
- This warranty shall be void if the boiler is installed by someone other than a qualified contractor whose principal occupation is the sale or installation of plumbing and heating equipment.
- This warranty shall be void if the owner fails to have the boiler serviced or inspected at least once every two years by an experienced and qualified service person.

EXCLUSIONS: Expressly excluded from coverage by this limited warranty are the following:
- Ordinary wear and tear, repairs or replacements necessitated by normal home use as described in the Installation and Operation Manual.
- Repairs or replacements arising from the effects of corrosive water supply or corrosive products of combustion.
- Repairs or replacements arising from the use of the boiler in a “cold start” system.
- Repairs or replacements of fittings, motors, fuel units, oil and gas burners, and all other controls, relief or regulating valves, transformers, and accessories.
- Repairs or replacements to repair damage caused by operation in violation of the instructions or cautions set forth in the installation and operation instruction manual.
- The repair or replacement of any component furnished by any other manufacturer or damage caused by the

functioning or malfunctioning of any such component.
- Repairs or replacements caused by thermal shock.

PURCHASER'S LEGAL RIGHTS: This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state. This warranty shall not be construed as inconsistent with any federal, state or municipal law or any regulations promulgated in connection herewith.

Questions regarding this warranty may be referred to

Economically Sensible, Environmentally Friendly, Ecologically Responsible
Eco Heat Sales
Leading the way to responsible renewable and efficient heating comfort
Gene Knight, CEO
545 Morley Potsdam Road
Canton, NY 13617
Phone: 315-386-2878 Fax: 315-386-3009
Email: info@ecoheatonline.com www.ecoheatonline.com

HOW AND WHERE TO GET SERVICE. Repairs or replacements under this limited warranty must be performed by your dealer or someone authorized by him. You may be required to present this limited warranty to the dealer before any work is performed. You must pay for any work performed which is not covered by this limited warranty or which is not authorized by the dealer.

Disposal and Recycling of Boiler Components

EKO boilers contain steel, electronic components, insulation and other materials that may be subject to local, state or federal regulations as to their proper disposal. When retiring an EKO boiler from service, make sure that all applicable laws, rules and regulations are observed. When in doubt, check with your local regulating authority for scrapping and disposal guidelines.